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(72) Inventors:  
• Shirahama, Akira  
Shinagawa-ku, Tokyo (JP)  
• Miyazaki, Shinichiro  
Shinagawa-ku, Tokyo (JP)  
• Nakamura, Hitoshi  
Shinagawa-ku, Tokyo (JP)

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(71) Applicant: SONY CORPORATION  
Tokyo 141 (JP)

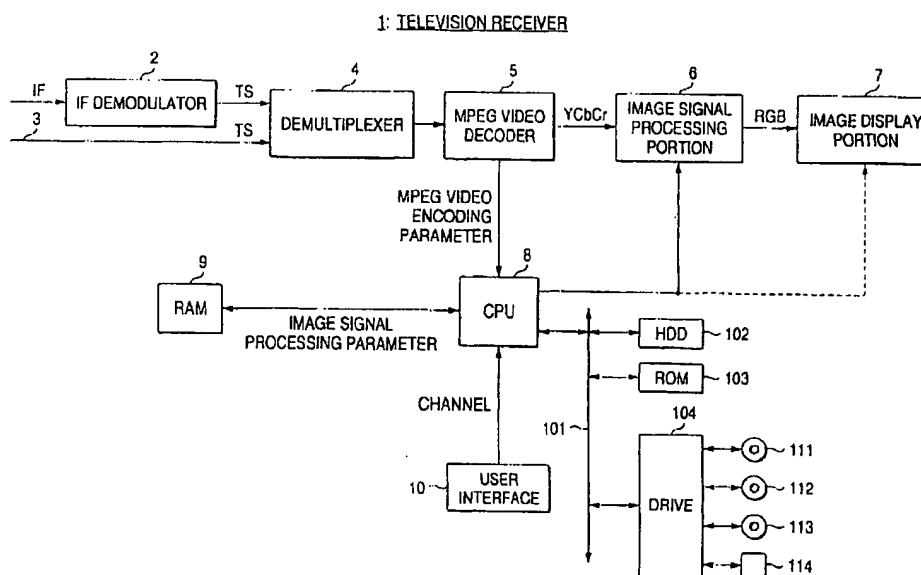
(74) Representative: Turner, James Arthur et al  
D. Young & Co.,  
21 New Fetter Lane  
London EC4A 1DA (GB)

(54) Image processing apparatus, image processing method, and recording medium

(57) Viewing of a program at optimum image quality is realized. A correspondence table of combinations of MPEG video encoding parameters and image signal processing parameters is stored in a RAM. A CPU reads out an image signal processing parameter correspond-

ing to a combination of MPEG video encoding parameters supplied from a demultiplexer from the RAM, and on the basis of the image signal processing parameter, controls an image signal processing in an image signal processing portion.

FIG. 4



## Description

[0001] The present invention relates to an image processing apparatus, an image processing method, and a recording medium, and particularly to an image processing apparatus, an image processing method, and a recording medium.

[0002] In recent years, digital broadcasting has begun in earnest. In the digital broadcasting, data such as an image or sound is compressed by an MPEG (Moving Picture Experts Group) system or the like and is broadcasted.

[0003] In digital television broadcasting, since the data is compressed, as compared with analog television broadcasting, a multi-channel and high quality content (program) can be broadcasted.

[0004] In a conventional television receiver, a function of setting various image qualities is added, and the image quality can be adjusted according to the taste of a user. When many kinds of contents, such as a still image and a character figure, in addition to a normal moving image, come to be broadcasted by the development of the digital television broadcasting, a more diversified and delicate image quality adjustment is desired.

[0005] However, since the setting of image quality in the conventional television receiver is performed by a manual operation while a user confirms a displayed image with the naked eye, delicate setting becomes difficult, and eventually, the user does not adjust the image quality for each program, but usually watches any program at the same image quality. As a result, there has been a problem that a high-grade function of the television receiver can not be sufficiently exhibited.

[0006] Various respective aspects and features of the invention are defined in the appended claims.

[0007] Embodiments of the present invention enable a user to always watch a program at optimum or at least improved image quality by automatically changing the setting of a screen display (e.g. an image quality setting) in accordance with the program.

[0008] An image processing apparatus of the present invention is characterized by comprising extraction means for extracting image data of a program selected by a user, acquisition means for acquiring image encoded information of the program extracted by the extraction means, and setting means for setting a signal processing parameter for processing an image signal of the program, in accordance with the image encoded information.

[0009] The extraction means of the image processing apparatus of the present invention may extract the image data of the program from a transport stream, and the acquisition means may acquire the image encoded information of the program from service information included in the transport stream.

[0010] The image processing apparatus of the present invention can further comprise storage means for storing the signal processing parameter for process-

ing the image signal.

[0011] The image processing apparatus of the present invention can further comprise changing means for changing the signal processing parameter by an input from the user.

[0012] An image processing method of the image processing apparatus of the present invention is characterized by comprising an extraction step of extracting image data of a program selected by a user, an acquisition step of acquiring image encoded information of the program extracted by processing at the extraction step, and a setting step of setting a signal processing parameter for processing an image signal of the program, in accordance with the image encoded information.

[0013] A program of a recording medium of the present invention is characterized by comprising an extraction step of extracting image data of a program selected by a user, an acquisition step of acquiring image encoded information of the program extracted by processing at the extraction step, and a setting step of setting a signal processing parameter for processing an image signal of the program, in accordance with the image encoded information.

[0014] In the image processing apparatus, the image processing method, and the recording medium according to the present invention, the signal processing parameter for controlling the display of a picture of the program is set in accordance with the image encoded information of the program selected by the user. Accordingly, it becomes possible to watch the program easily at the optimum screen quality without carrying out a complicated operation.

[0015] The invention will now be described by way of example with reference to the accompanying drawings, throughout which like parts are referred to by like references, and in which:

FIG. 1 is a block diagram showing a structural example of a television receiver to which the present invention is applied;

FIG. 2 is a flowchart for explaining the operation of the television receiver of FIG. 1;

FIG. 3 is a view showing an example of MPEG video encoding parameters; and

FIG. 4 is a block diagram showing a structural example of another television receiver to which the present invention is applied.

[0016] FIG. 1 shows a structural example of a television receiver 1 which receives a digital broadcast transmitted from a not-shown broadcasting station and displays (outputs) an image and sound.

[0017] An IF demodulator 2 demodulates an IF (Intermediate Frequency) signal obtained from a digital broadcast wave received by a not-shown antenna and outputs it as a transport stream to a demultiplexer 4.

[0018] Besides, a transport stream transmitted from

a CATV system, a network system or the like is supplied to the demultiplexer 4 through a transmission path 3.

[0019] The demultiplexer 4 separates a TS packet including image data from transport stream packets (hereinafter suitably referred to as TS packets) constituting the supplied transport stream, and outputs it to an MPEG video decoder 5.

[0020] The TS packet holding the image data is decoded in the MPEG video decoder 5, and is outputted to an image signal processing portion 6. Besides, MPEG video encoding parameters indicating information in relation to the encoding of the TS packet which is separated in the MPEG video decoder 5 and holds the image data are outputted to a CPU (Central Processing Unit) 8.

[0021] The image signal processing portion 6 generates an RGB signal from a decoded luminance signal and color-difference signal, and displays an image on an image display portion 7 including a CRT (Cathode-Ray Tube) or an LCD (Liquid Crystal Display).

[0022] The CPU 8 controls respective portions in response to an input from a user interface 10 for outputting a signal corresponding to an operation of a user. Data and programs necessary for the CPU 8 to execute various processes are stored in a RAM 9.

[0023] An HDD (Hard Disk Drive) 102, a ROM (Read Only Memory) 103, and a drive 104 are connected to the CPU 8 through a bus 101. As a recording medium, a magnetic disk 111, an optical disk 112, a magneto-optical disk 113, or a semiconductor memory 114 is mounted on the drive 104.

[0024] Next, the operation of the television receiver 1 of FIG.

[0025] 1 will be described with reference to a flowchart of FIG. 2.

[0026] At step S1, the IF demodulator 2 demodulates an IF signal obtained from a digital broadcast wave received by a not-shown antenna, generates a transport stream, and outputs it to the demultiplexer 4.

[0027] At step S2, the demultiplexer 4 separates a TS packet holding video data of an objective program from PSI (Program Specific Information) and SI (Service Information) included in the supplied transport stream, and outputs it to the MPEG video decoder 5. The PSI means specification information of a program (broadcast program) prescribed by the MPEG, and is constituted by four tables of a PAT (Program Association Table), a PMT (Program Map Table), a NIT (Network Information Table), and a CAT (Conditional Access Table) and various descriptors. The SI is information which a broadcasting business body uniquely uses.

[0028] At step S3, the MPEG video decoder 5 decodes the TS packet including the video data by the MPEG system, generates a luminance signal (Y) and color-difference (Cr, Cb) signals, and outputs them to the image signal processing portion 6. In the present invention, in order to cause the optimum image to be displayed on the image display portion 7, signal processing executed in the image signal processing portion 6 is

controlled in accordance with the image signal processing parameter acquired by the CPU 8. Then, the MPEG video decoder 5 extracts the MPEG encoding parameters as shown in FIG. 3, which describe information in relation to the encoding of the video data, and outputs them to the CPU 8.

[0029] In an example of the MPEG video encoding parameters of FIG. 3, profile/level designation is MP/HL (Main Profile/High Level), the number of horizontal pixels is 1920, the number of vertical lines is 1080, an aspect ratio is 16:9 display, a bit rate is 22 Mbps, a frame rate is 30/1.001 Hz, a scan system is a sequential scanning (progressive scanning) system, a color initial value, a conversion characteristic, and a matrix coefficient are prescribed values of ITU-R recommendation BT. 709, and a repeat first flag is a flag used at 2:3 pull down.

[0030] At step S4, the CPU 8 searches and sets image signal processing parameters corresponding to a combination of the MPEG video encoding parameters, which are supplied from the MPEG video decoder 5, from a correspondence table of the MPEG video encoding parameters and the image signal processing parameters, which is previously stored in the RAM 9. For example, in the case where the combination of the supplied MPEG video encoding parameters is such that profile/level is MP/HL, the number of display pixels/frame rate is 1920 X 1080/24P, and the bit rate is 22 Mbps, the CPU 8 recognizes that the image data of the TS packet extracted from the transport stream is a movie of high image quality, and acquires and sets such image signal processing parameters as to lower the brightness, as to attenuate the sharpness, as to lower color temperature, as to cut NR (Noise Reduction), as to cut VM (Velocity Modulation (beam velocity modulation)), and as to strengthen gamma correction, from the correspondence table of the combination of the MPEG video encoding parameters and the image signal processing parameters, which is stored in the RAM 9. On the basis of these image signal processing parameters, the CPU 8 controls the signal processing in the image signal processing portion 6, so that all of delicate gradation of a dark portion, a profile, and color can be displayed with a soft touch, and the quality of an original film can be displayed.

[0031] At step S5, on the basis of the image signal processing parameters set by the CPU 8, the image signal processing portion 6 processes the luminance signal and the color-difference signals supplied from the MPEG video decoder 5, generates an RGB signal, and outputs it to the image display portion 7.

[0032] At step S6, the image display portion 7 displays an image on the basis of the RGB signal supplied from the image signal processing portion 6.

[0033] In the above, although the signal processing in the image signal processing portion 6 is controlled on the basis of the image processing parameters, as shown in FIG. 4, it is also possible to further control the image display portion 7.

[0034] In the present embodiments, it is also possible to change the setting of the image signal processing parameters in such a manner that the user operates the user interface 10 according to the taste of the user. Here, the image signal processing parameters the setting of which is changed are stored in the RAM 9, and thereafter, also in the case where the same program (series program) is selected by the user, the signal processing in the image signal processing portion 6 and the image display portion 7 is controlled on the basis of the same image signal processing parameters, and the image is displayed.

[0035] The present invention can also be applied to an audio signal. For example, in the case where signal processing as to data of a music program is carried out, with respect to a video signal, the above described image signal processing is carried out and is displayed, and with respect to the audio signal, sound signal processing parameters are set from a combination of MPEG audio encoding parameters, and a sound signal processing portion and a sound output portion can be controlled as well.

[0036] Further, in the case where a plurality of images are displayed on a plurality of windows of one screen at the same time, a display (output) may be controlled for each of the images displayed on the respective windows.

[0037] In the above, although the description has been made on the case where the present invention is applied to the television receiver, the present invention can be applied to any devices (for example, a personal computer, etc.) which process digital data, including an IRD (Integrated Receiver/Decoder).

[0038] Although the foregoing series of processes can be executed by hardware, they can also be executed by software. In the case where the series of processes are executed by software, a program constituting the software is installed from a recording medium to a computer integrated in dedicated hardware, or, for example, a multi-purpose personal computer which can execute various functions by installing various programs.

[0039] As shown in FIG. 1, this recording medium is constituted not only by a package medium which is separate from a computer and is distributed to the user to provide a program and in which the program is recorded, such as the magnetic disk 111 (including a floppy disk), the optical disk 112 (including a CD-ROM (Compact Disk-Read Only Memory), and a DVD (Digital Versatile Disk)), the magneto-optical disk 113 (including MD (Mini-Disk)), or the semiconductor memory 114, but also by the ROM 103 or the HDD 102 which is provided to the user in the state where it is previously integrated in the computer and in which the program is recorded.

[0040] Incidentally, in the present specification, steps describing the program recorded in the recording medium naturally include processes carried out in time series along the recited sequence, and also include processes which are not necessarily processed in time series but

are executed in parallel or individually.

[0041] Besides, in the present specification, the system indicates an entire apparatus constituted by a plurality of devices.

[0042] In so far as the embodiments of the invention described above are implemented, at least in part, using software-controlled data processing apparatus, it will be appreciated that a computer program providing such software control and a storage medium by which such a computer program is stored are envisaged as aspects of the present invention.

## Claims

1. An image processing apparatus for receiving and processing image data of a predetermined program, comprising:

extraction means for extracting the image data of the program selected by a user;  
acquisition means for acquiring image encoded information of the program extracted by the extraction means; and  
setting means for setting a signal processing parameter for processing an image signal of the program, in accordance with the image encoded information.

2. The image processing apparatus according to claim 1, wherein:

the extraction means extracts the image data of the program from a transport stream; and  
the acquisition means acquires the image encoded information from service information included in the transport stream.

3. The image processing apparatus according to claim 1, further comprising storage means for storing the signal processing parameter.

4. The image processing apparatus according to claim 3, further comprising changing means for changing the signal processing parameter by an input from the user.

5. The image processing apparatus according to claim 1, further comprising processing means for processing the image signal of the program in accordance with the signal processing parameter set by the setting means.

6. The image processing apparatus according to claim 1, further comprising display means for displaying the processed image signal of the program.

7. The image processing apparatus according to claim

- 6, wherein the display means is further controlled in accordance with the image encoded information.
8. An image processing method of an image processing apparatus for receiving and processing image data of a predetermined program, comprising: 5
- an extraction step of extracting the image data of the program selected by a user;
  - an acquisition step of acquiring image encoded information of the program extracted by processing at the extraction step; and 10
  - a setting step of setting a signal processing parameter for processing an image signal of the program, in accordance with the image encoded information. 15
9. The image processing method according to claim 8, wherein: 20
- at the extraction step, the image data of the program is extracted from a transport stream; and
  - at the acquisition step, the image encoded information is acquired from service information included in the transport stream. 25
10. The image processing method according to claim 8, further comprising a storage step of storing the signal processing parameter. 30
11. The image processing method according to claim 10, further comprising a changing step of changing the signal processing parameter by an input from the user. 35
12. The image processing method according to claim 8, further comprising a processing step of processing the image signal of the program in accordance with the signal processing parameter set at the setting step. 40
13. The image processing method according to claim 8, further comprising a display step of displaying the processed image signal of the program. 45
14. The image processing method according to claim 13, wherein the image signal of the program at the display step is further controlled in accordance with the image encoded information. 50
15. A recording medium storing a computer readable program, in which the program of an image processing apparatus for receiving and processing image data of a predetermined program comprises: 55
- an extraction step of extracting the image data of the program selected by a user;
  - an acquisition step of acquiring image encoded

information of the program extracted by processing at the extraction step; and  
a setting step of setting a signal processing parameter for processing an image signal of the program, in accordance with the image encoded information.

FIG. 1

## 1: TELEVISION RECEIVER

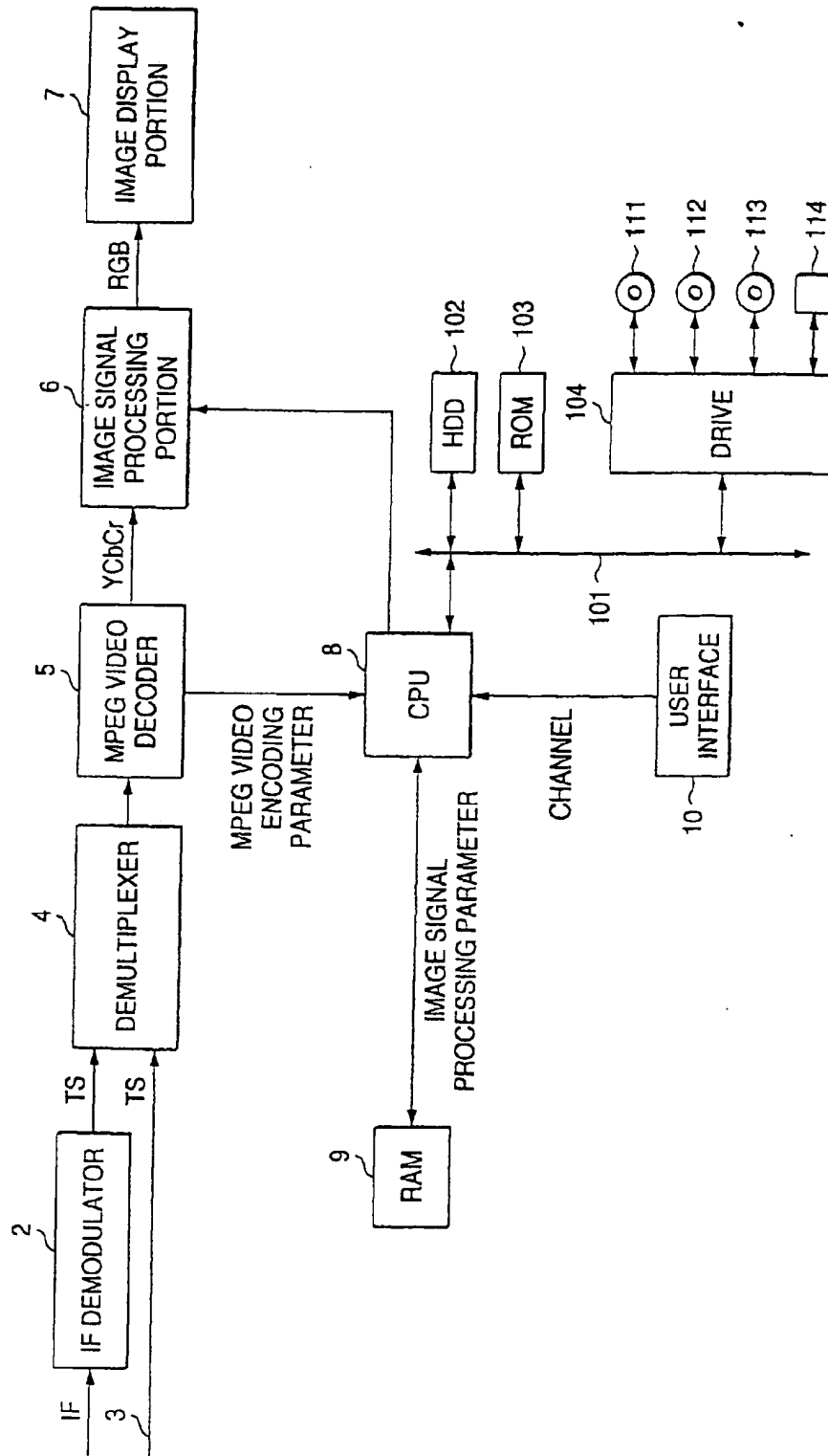


FIG. 2

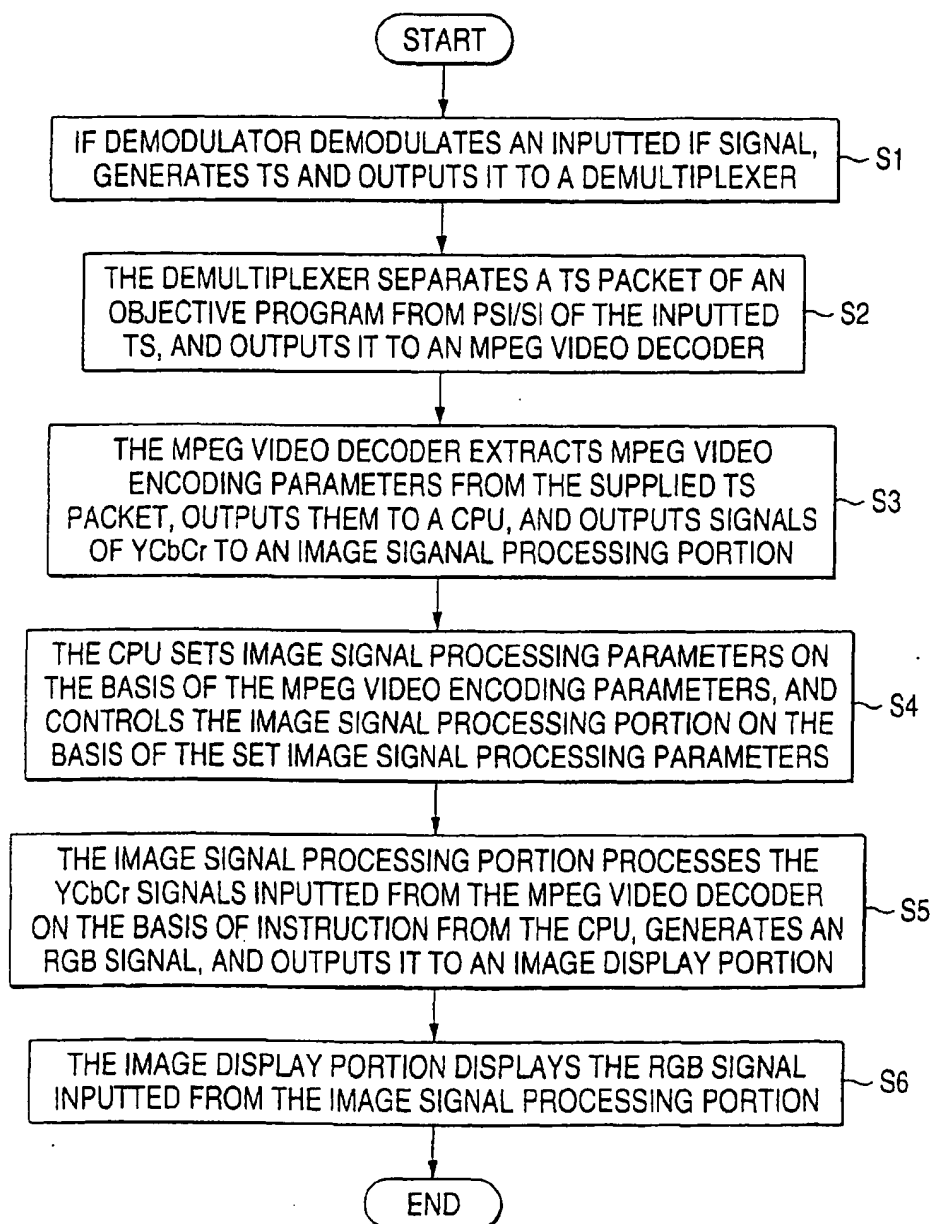


FIG. 3

MPEG VIDEO ENCODING PARAMETER (EXAMPLE)

PROFILE/LEVEL DESIGNATION	MP/HL
NUMBER OF HORIZONTAL PIXELS	1920
NUMBER OF VERTICAL PIXELS	1080
ASPECT CC	16:9 DISPLAY
BIT RATE	22Mbps
FRAME RATE	30/1,001Hz
SCANNING SYSTEM	SEQUENTIAL SCANNING
COLOR INITIAL VALUE	PRESCRIBED VALUE OF ITU-R RECOMMENDATION BT. 709
CONVERSION CHARACTERISTIC	PRESCRIBED VALUE OF ITU-R RECOMMENDATION BT. 709
MATRIX COEFFICIENT	PRESCRIBED VALUE OF ITU-R RECOMMENDATION BT. 709
REPEAT FIRST FLAG	FLAG USED AT 2:3 PULL DOWN



FIG. 4

## 1: TELEVISION RECEIVER

